EXECUTIVE SUMMARY

The Coast Guard Telecommunications Plan (TCP) describes the near to mid-term telecommunications goals and objectives for Command, Control, and Communications (C3) support. It is intended to document internal telecommunications planning and to provide initial guidance on which Coast Guard telecommunications decisions are based. The plan also addresses Coast Guard current and future telecommunications requirements, systems, networks, and capabilities. It also highlights existing operational deficiencies and planned improvements and upgrades.

The Plan, like the Coast Guard Telecommunication System (CGTS), is an evolving document that needs periodic review and revision. The TCP thoroughly documents the current Coast Guard telecommunications architecture, current and future requirements, and technology assessments.

Changes within the organization (i.e., streamlining initiatives, multi-year budget strategies, and cost cutting measures) require accurate program guidance and planning documentation, making this a critical planning document.

Current (Baseline) Telecommunication System

The CGTS has a complex network of interconnected systems that link all Coast Guard facilities (i.e., shore units, aircraft, cutters, boats, etc.). These critical links provide the means to pass voice, data, and video transmissions from facility to facility.

The existing sub-systems provide users with the basic connectivity critical to the baseline system. These subsystems include:

Voice

The TCP identifies several voice communication systems that the Coast Guard uses on a day-to-day basis. They include:

- Telephone
  - Federal Telecommunications System (FTS)
  - Defense Switched Network (DSN)
  - Search and Rescue Telephone (SARTEL)
  - Direct Distance Dialing (DDD)
- Radio
  - Medium Frequency (MF) Distress and Safety System

- High Frequency (HF) Command & Control/Maritime Public Support
- Very High Frequency (VHF) Maritime National Distress System/Short Range Command & Control
- Ultra High Frequency (UHF) Radio
- VHF Direction Finding
- Digital Selective Calling (DSC)

Data

Most of the Coast Guard's mission areas rely heavily on the transfer of information. It is critical that the communication links that transmit and receive this important information meet user requirements. This section discusses the methods or links by which the Coast Guard transmits this data.

- Radio
  - Radio Teletype (RATT)
  - Narrow Band Direct Printing (NBDP)
  - Navigational Telex (NAVTEX)
  - High Frequency Data Link (HFDL)
  - Satellite Communications (SATCOM)
- Landline
  - Coast Guard Data Network (CGDN)
  - Standard Semi-Automated Message Processing System (SSAMPS)
  - Automatic Digital Network (AUTODIN)
  - Secure Data Network (SDN)
  - Teletypewriter Exchange Network (TELEX/TWX)
  - Imagery and Facsimile (FAX)
  - World-Wide Military Command and Control System (WWMCCS)
  - Secret Internet Protocol Router Network (SIPRNET)

- Anti-Drug Network (ADNET)

Video

Video teleconferencing is divided into three general categories: satellite-based broadcast video teleconferencing, desktop video teleconferencing, and group (large or small) video teleconferencing. Video services may also include video to the desktop in training applications, such as interactive courseware replacing or supplementing "A" and "B" schools. Video teleconferencing offers the potential to significantly reduce travel costs and increase productivity. It is a tool which can greatly improve the work processes between units by offering quick, affordable, and efficient communications. Reductions in travel costs alone will justify the installation of video teleconferencing in many locations.

Contingency Communications

Coast Guard Contingency Communications consist of the following:

- Transportable Communications Centrals (TCCs). These are self-contained communications platforms designed to provide support when temporary communications facilities are required at short notice.

- Other Contingency Equipment. Both CAMS have additional deployable communication systems to support Coast Guard emergency and special operations. These systems include an inventory of:

  - Portable DAMA units (SATCOM)

  - Portable LCCS-300 suitcase (SATCOM Line of Site)

  - Portable INMARSAT "A" Phones (voice only)

- District Contingency Equipment. Each District has a variety of portable communications equipment for contingency operations. Usually it is held at the District/Area COMMCEN and issued as necessary. The following are examples of equipments available from the staffs:

  - ERNIE Modems (2 ea. CODEX 5000, X.500) for dial-up connection to CGDN on CGSW-II

  - Portable VHF Base Stations

  - Portable HF Stations

  - Portable INMARSAT Units

  - Portable DAMA Units

- Portable LST5s
- Handheld VHF transceivers
- Deployable cellular telephones

Systems/Applications

The following major systems and mission essential applications are used by various Headquarters Program Managers to support their mission requirements:

- Aviation Logistics Management Information System (ALMIS)
- Automated Mutual-assistance Vessel Rescue System (AMVER)
- Aids To Navigation Information System (ATONIS)
- Auxiliary Management Information System (AUXMIS)
- Computer Aided Search Program (CASP)
- Fleet Logistics System (FLS)
- Geographic Display Operations Computer (GDOC)
- Joint Maritime Information Element (JMIE)
- Law Enforcement Information System II (LEIS-II)
- Large Unit Financial System (LUFS)
- Marine Safety Network (MSN)
- Personnel Information Management System/Joint Uniformed Military Pay System (PMIS/JUMPS)
- Search and Rescue Management Information System (SARMIS)
- Standard Automation Requisitioning (STAR)
- Supply Center Computer Replacement (SCCR) Project

Future Requirements

The TCP describes all Program Manager future voice, data, and video telecommunications requirements, organized by the distinct interviews with Program Managers and by mission area.

These requirements are prioritized to meet the overall strategy of the Coast Guard including projected mission priorities.

During Program Manager interviews, it was clear that many managers have the vision of future Coast Guard operations. Their vision provided some high level communications requirements. Most of the participants, however, were not able to quantify those requirements in terms of bandwidth which is the range of electrical frequencies a device can handle. In simpler terms, it is the capacity to move information.

Several Program and Support Manager Staffs were solicited for input to the requirements process. As a result, fifteen separate interviews were conducted with various representatives of those staffs. Replies to prepared questions, ranging from general solicitations on future views of the Coast Guard's general needs for communications services to specific inquiries about system bandwidth requirements, ran the gamut: validated requirements, not validated requirements, and solutions. Interviewee responses were further refined into requirements that could be validated in the concurrent clearance process. The reports, on each of the interviews, are on file with the Commandant (G-SCT) staff.

The following Program Managers were interviewed: G-A, G-CFP, G-L, G-M, G-OC, G-OP, G-SE/SLS, G-SEA, G-SC, G-SI, G-WK, G-WP/WT

Future telecommunications requirements are listed in the TCP by Program and later in priority order by mission. The following is a prioritized list of those requirements beginning with the requirement considered the most important:

1. Automated Systems/One Time Data Entry
2. Network-of-Networks
3. Formal and Informal Message Delivery
4. Centralized Data Storage and Access
5. Data Security
6. Video & Imagery
7. Interoperability
8. Remote Access (dial-in)
9. World-wide internal access to Critical CG DB & Applications
10. Mobile Communications
11. Automated Chart Updates

12. World-wide Public Access to Coast Guard Databases
13. Provide Navigation Information Service
14. Short Range Radio Communications
15. Satellite Communications
16. Solution to Cutter Antenna Interference Problem
17. User Pull
18. Consolidated Management Reporting System
19. Direction Finding Capabilities
20. Video Teleconferencing
21. Telecommuting
22. Open Systems Architecture
23. Digital Signature Standard
24. Telemedicine Capability
25. User Charge-back
26. Global Dial-tone

These requirements were compared to the Baseline Architecture and with the gaps identified in the C4I Baseline Architecture Document. Each of these requirements relates to one or more of the critical gaps which are listed in Section 3.7 of the TCP, and reference is made to the gap which most closely relates to the requirement. The critical gaps, in Section 3.7, directly relate to gaps identified in the C4I Baseline Architecture Document.

The Telecommunications Plan and the C4I Baseline Architecture and Plan are related in many areas, and synergy was obtained by ensuring that these efforts were completed hand-in-hand. Significant input, to the development and preparation of the Program Manager Interview questions, was obtained from drafts of the C4I Baseline Architecture document. The C4I document identified critical gaps in capabilities. These gaps correlate directly to many of the future requirements addressed in the Telecommunications Plan. The focus of the Telecommunications Plan differs from the C4I Baseline Architecture in that it is limited to communications requirements, but it addresses these requirements throughout the Coast Guard. Accordingly, the Telecommunications Plan incorporates several programs not addressed by the C4I efforts, particularly administrative and support. For this reason, not all requirements, in the Telecommunications Plan, will link directly to the critical gaps discussed in the C4I documents.

The following gaps between the TCP baseline architecture and the future requirements were identified. The process established the framework for an assessment of relevant technologies and recommended solutions. The resulting list shows the most critical gaps in Coast Guard communications capabilities. These gaps include:

- Communications Connectivity
- Maritime Public Support
- Interoperability
- Information Exchange
- Data Security
- Decision/Tactical Support
- C3 Systems

All of the requirements and gaps involve movement of data into, out of, and within the Coast Guard. Most of that movement requires a Wide Area Network (WAN) with the ability to connect with all Coast Guard entities. One significant task is the determination of the volumes of data that must move concurrently on the circuits at any point in time. This problem has been compared to liquid transportation through pipelines. The data problem is sometimes referred to as "sizing the pipes." The whole process is important, since the cost of the network is very much related to the "size of the pipes" to all Coast Guard personnel.

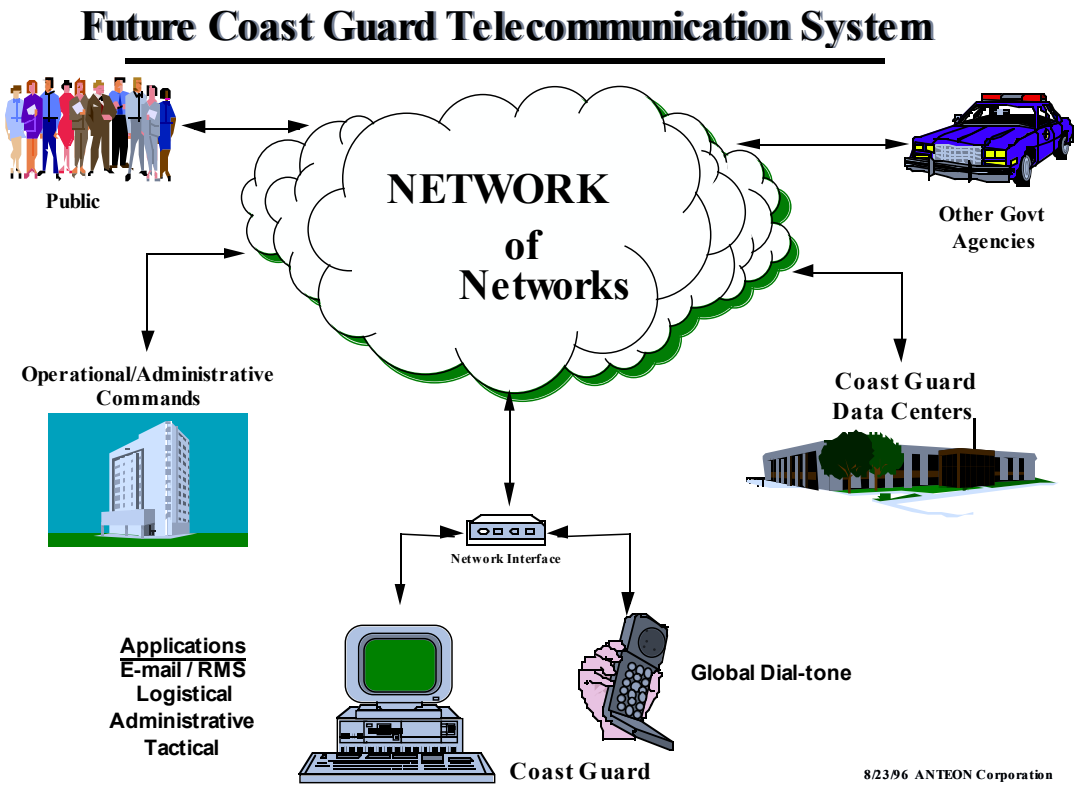
Different legs of the network may require different magnitudes of data flow. The requirements for a Coast Guard WAN are an accumulation of all the requirements from Coast Guard applications producing data for movement within the organization. There are only two program/application managers who have produced detailed quantified studies of their data communication requirements. They are G-W for the Personnel Management Information System II (PMIS II) and G-S for the Fleet Logistics System (FLS).

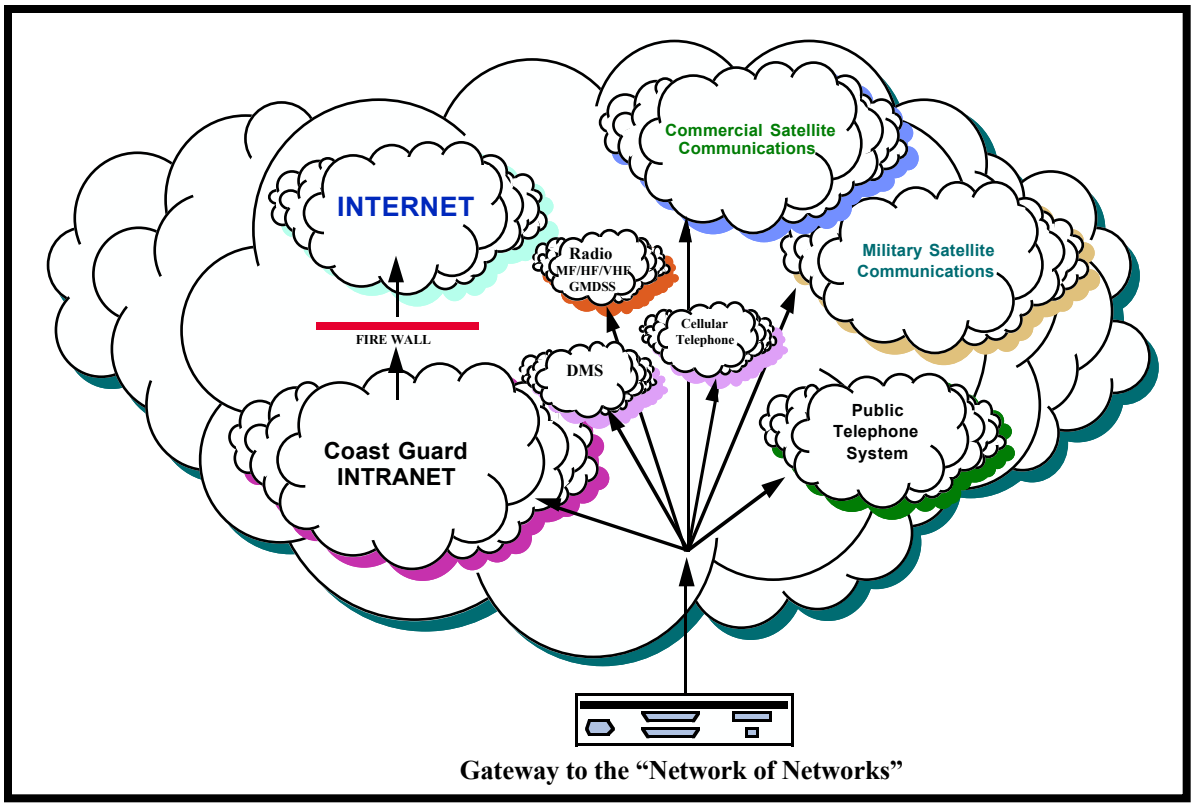
An estimate of the peak bandwidth that communications circuits at OSC Martinsburg will be required to support is approximately 2200 kbps. This is equivalent to about one and one-half T1 circuits.

Network-of-Networks

On the following page, is a user's perspective of the network of the future. Users will use one telephone to meet all voice requirements and one workstation to meet all data and video needs. The network itself will be transparent to the user who will be connected to the network by an intelligent gateway. The gateway will automatically select the best path from originator to addressee, depending on the type of service (i.e., voice telephone calls, record message traffic, applications, etc.) and based on whether the call is a voice, data, or video transmission. The Network-of-

Networks is the vision of the future (10-15 years). Technology is not currently available to implement all aspects of this all-encompassing networking solution. However, technology is in place or will be in place in the next 5 years to implement significant portions of this vision.





Technology Assessment

After accomplishing two very important tasks, documenting the baseline architecture and developing a comprehensive list of future telecommunications requirements, several technology areas were assessed. These were (1) Data Networking, (2) Mobile Communications, and (3) Requirements for Interoperability with DoD. The networking technologies were analyzed at a high level to determine their potential for addressing current and future requirements, and their impacts on the Coast Guard's future architecture.

Data Networking

Several data networking technologies were identified that showed potential for meeting the Coast Guard's current and future data networking requirements. These technologies, which encompass both dedicated and on-demand networking connections, include X.25, Asynchronous Transfer Mode (ATM), Frame Relay, Integrated Services Digital Network (ISDN), Point-to-Point networking services, and Very Small Aperture Terminal (VSAT) networking. Also important in the planning for the future network architecture is the Defense Message System (DMS), which will have a considerable impact on the Coast Guard's data networking solution.

Initial cost estimates, which include installation charges and basic monthly rates, along with equipment purchase costs, were determined using a sample network configuration consisting of two remote units (Atlantic and Pacific Area) connected to a central site (OSC Martinsburg). This limited network architecture was considered adequate for high-level cost comparison purposes.

Mobile Communications

Several wireless networking alternatives were analyzed, including High Frequency (HF) and Satellite Communications (SATCOM) point-to-point communication technologies and services. These technologies include the following:

- Spread-Spectrum Packet Radio
- Low Earth Orbit Satellite (LEOS) System (i.e., Iridium, Globalstar)
- Regional Satellite System (i.e., AMSC)
- International Maritime Satellite (INMARSAT)
- Very Small Aperture Terminal (VSAT) (DirecPC)
- Military Satellite Communications (MILSATCOM)
- Cellular Networks (i.e., Standard and CONDOR capable cellular service)
- Traditional High Frequency (HF) Wireless Communications
- Tactical Defense Message System (DMS)

DoD Interoperability

The Coast Guard operates in a multi-mission environment which includes increasing requirements to participate in combined operations with DoD. One factor critical to continued mission success, improved readiness, and enhanced quality of life for mobile forces will be the ability to share information, seamlessly, and in real-time or near real-time through flexible, adaptable, interoperable communications systems.

The current communications systems will not meet the throughput demands of the future. However, taking a "Networks-of-Networks" approach will lead to the fielding of communications assets that are inter-operable and flexible enough to meet the throughput demands of today's and tomorrow's Coast Guard operational units.

Several technologies were explored and analyzed at a high level to determine their potential for addressing current and future requirements, and their impacts on the Coast Guard's future telecommunications architecture.

It was determined that several current and emerging telecommunications technologies, each with unique capabilities, will be used in conjunction with one another to make up the future "Network-of-Networks". This all encompassing system will move all types of information seamlessly from place to place within the Coast Guard and also interface with other government agencies through direct circuits and network gateways. Some of these technologies are already in place and in

operation, some will be the result of future procurements, and others will be provided to the Coast Guard by DoD to promote interoperability, and support the requirement for Coast Guard/Navy compatibility.

For record message traffic and electronic mail delivery, and providing the transport medium for mission essential applications, the "Network" will provide access to the following basic services:

- Dedicated DoD Networks (i.e., Defense Information System Network (DISN), Integrated Tactical/Strategic Data Network)
- Defense Message System (DMS)
- Electronic Mail Exchange
- MILSATCOM
- Electronic Data Interchange
- Defense Satellite Communications System (DSCS)
- Global Broadcast System (GBS)
- Cellular Telephone
- Regional Satellite Systems
- INMARSAT
- Traditional HF Communications Systems
- Digital Modular Radio System
- Integrated Terminal Program
- Automated Digital Network

Technology Alternatives

With consideration given to capability limitations and/or operating costs, there is no specific technology that will meet all Program Manager needs. However, by carefully selecting, analyzing, and combining several technologies into one all encompassing "Network-of-Networks," and thus allowing them to complement and enhance each others' capabilities, a comprehensive networking solution was developed.

The TCP presents a high level view of several possible networking solutions. Each alternative solution is based on an initial capabilities assessment, technology availability, and cost analysis.

Each alternative contains a mix of data, mobile, and interoperability technologies, which together produce a networking solution to meet all voice, data, and video communications requirements.

Other systems, not listed as an integral part of the networking alternatives, such as DISN, were investigated as possible networking solutions during the high-level technology analysis. These systems were not considered to be viable solutions due to one or more outstanding deciding factors. These include costs, bandwidth availability concerns, priority allocations constraints, and responsiveness to Coast Guard needs.

The table on the following page shows the technologies selected for each networking alternative to form a hybrid networking solution that will meet all Coast Guard voice, data, and video service requirements:

Alternative	Systems and Units	#1	#2	#3
Data	CGDN+ Tier 1 Backbone	Point-to-Point	Point-to-Point	ATM
	CGDN+ Tier 2	Frame Relay	VSAT	
	CGDN+ Tier 3/4	Dial-up ISDN	VSAT	ISDN Dial-Up
	Tactical DMS to 378's/270's, DOD trfc for all others	DMS Gateways	DMS Gateways	DMS Gateways
	Tactical/record msg trfc to 378's/270's, LMCG to 210s	MILSATCOM	MILSATCOM	MILSATCOM
	MEAs to all units	Commercial SATCOM - Regional Satellite - Inmarsat	Commercial SATCOM - VSAT - LEOS	Commercial SATCOM - LEOS
	GMDSS reqt/sat backup to mobile units, HFDL WPB/WLB	MF/HF Radio Comms	MF/HF Radio Comms	MF/HF Radio Comms
	Public	INTERNET	INTERNET	INTERNET
Voice	Shore ops/mobile, distress/C3	VHF-FM	VHF-FM	VHF-FM
	GMDSS reqt/sat backup	MF/HF Radio Comms	MF/HF Radio Comms	MF/HF Radio Comms
	Tactical voice on 378/270's	MILSATCOM	MILSATCOM	MILSATCOM
	Admin and C3 voice for shore and mobile units	Commercial SATCOM - Regional Satellite - Inmarsat	Commercial SATCOM - LEOS	Commercial SATCOM - LEOS
	Emerg, admin and C3 comms for shore and mobile units	CONDOR	Cellular Service	CONDOR
Video	All units with terrestial connection	PSTN	PSTN	PSTN

The first alternative is a network configuration based primarily upon proven, currently available technologies with minimum developmental risk. It consists of several data and voice technologies that combined will meet all record message, mission essential application, and tactical communications needs. These technologies include Point-to-Point and Frame Relay technology, with ISDN dial-up capabilities where needed; and MILSATCOM, Commercial SATCOM, and traditional MF/HF for wireless communications support.

The second alternative is based upon high-probability of success technologies being deployed in the near future. (These technologies are anticipated to provide significant opportunities to improve Coast Guard communications processes.) This alternative is similar to Alternative 1, however, SATCOM is used more extensively to meet shore-side and wireless communications requirements.

The third alternative includes other potential high impact technologies, such as ATM, which are available or anticipated and have not been considered in Alternative 1 or 2.

Recommended Future Architecture

Having carefully reviewed each of these alternatives the Coast Guard selected two networking solutions for complete analysis.

In short, the analysis considered the following elements: cost/benefit, engineering feasibility, stakeholders, resource savings, time and ease of implementation, risk, trade-off (cost/time/performance), and force field analysis (weighing issues for and against migration to a new system).

The following alternatives were selected by the Coast Guard for further analysis.

- Alternative 1: includes a combination of Point-to-Point and Frame Relay networking technology, using T1 circuits running TCP/IP, for data communications, with ISDN services added to the lower tier network, where available and unique requirements dictate. Wireless communications requirements are met with a hybrid network of MILSATCOM, commercial SATCOM, and traditional MF/HF radio communications. Specialized cellular telephone services (i.e., CONDOR) will be used for high priority clear and secure voice and data communications, and will be available, as a backup, to meet operational and administrative communications requirements.

  The above combination of data and voice technologies will meet all record message, e-mail, mission essential application, tactical communications, and video teleconferencing needs.

- Alternative 2: combines Point-to-Point networking technology with commercial Very Small Aperture Terminal (VSAT) SATCOM services to meet all shoreside data communications needs. Wireless communications requirements are met with MILSATCOM, commercial Low Earth Orbit Satellite (LEOS) services, and traditional MF/HF radio communications. Alternative 2 is based upon current and high-probability of success technologies being deployed by other enterprises in the near future. (These technologies are anticipated to provide significant opportunities to improve Coast Guard communications processes.) This alternative is similar to Alternative 1. However, commercial SATCOM is used more extensively, in Alternative 2, in order to meet shore-side and wireless communications requirements.

  If the new systems and technologies mature as expected, Alternative 2 will meet the Coast Guard's requirements as well as Alternative 1.

- In addition to the two alternatives discussed above, ATM technology was also analyzed as a possible wide area network (WAN) solution. This evaluation was accomplished by comparing network (Tiers-1 and 2) solutions in each of the three WAN technologies.

Alternatives 1 and 2, and ATM were analyzed to determine the cost and engineering feasibility of future implementation. Each alternative included several technologies that are already in use and supported by the Coast Guard. Although these technologies are an integral part of the future network, they do not impose an impact on either the cost of implementation or the operation of the new system. Therefore, they are considered to be a "constant" factor, and were not included in the life cycle costing of the new network. Technologies that are new or will otherwise impact the cost of implementation or operation of the new system were included in the LCCE.

Final Recommendation and Migration Plan

A final recommendation for network design was concluded after a close examination of all available technologies, and detailed discussions with Coast Guard network planners and engineers. This recommendation is based on cost, availability and reliability factors, open systems compliance, and network improvement initiatives currently in progress (i.e., Coast Guard Data Network (CGDN) Plus).

The selected internetworking architecture applies to all Coast Guard mission areas and will meet all voice, data, and video requirements. This architecture was developed from detailed analysis of data, mobile, and interoperability technologies, and input received from Program Managers and key Coast Guard personnel during TCP development.

The architecture for the data segment of the Coast Guard Network-of-Networks, known as CGDN Plus, is based upon proven technologies with minimum developmental risk. It was chosen because it is currently the most flexible and scaleable network. As technology changes, the network can be quickly changed to meet customer requirements. In the future, certain economies of network cost may be realized through the use of other technologies. Consequently, the business case may result in a hybrid network.

Several other new technologies, which are needed to achieve the future network architecture (year 2003), such as LEOS and specialized cellular service (CONDOR), are expected to be available in 1998. However, the Coast Guard should not commit to implementing new technology until it has been thoroughly tested and operated commercially for a reasonable period of time.

To allow for this, we have developed a three-phased approach to implementation of the new network, as described below.

- **1998**
  - ✧ T1 Point-to-Point connectivity on the Coast Guard Data Network.
  - ✧ ISDN or FTS2000 dial-up services to meet unique requirements.
  - ✧ Connect to DMS via strategically located DMS gateways.
  - ✧ Commercial Satellite services for world-wide mobile coverage at the least cost.

- ✧ MILSATCOM for primary ship-shore message traffic delivery.

- ✧ Traditional MF/HF Radio Communications will continue to be available, on a limited basis, to provide ship-to-ship, ship-to-shore, and air-to-ground voice communications (i.e., SAR and L/E operations, etc.).

- ✧ INTERNET for public access to Coast Guard information via "home pages".

- ✧ VHF-FM for maritime public support.

- ✧ Cellular Telephones for high priority communications, and as a backup system for administrative and operational voice communications within the CONUS and portions of the CONUS Exclusive Economic Zone (EEZ) for land-based mobile units.

- ✧ Public Switched Telephone Network (PSTN) to meet video requirements. This can be arranged on an "as needed" basis which minimizes the recurring costs of leased lines.

- **2000**

The following changes/enhancements may be made to the "network" in the year 2000:

- ✧ T1 Point-to-Point backbone circuit connecting major Coast Guard units (i.e.., Headquarters, Areas, MLCs, Districts)

- ✧ Frame Relay connecting all smaller Coast Guard units.

- ✧ ISDN/FTS2000/VSAT to meet unique requirements not met by the Frame Relay network.

- ✧ Specialized Cellular Service may be used in lieu of standard cellular service. Dual mode secure cellular/satellite services, with broadcast capabilities, are expected to be available from multiple vendors by the year 2000.

- **2003**

Should the Coast Guard decide to accept Frame Relay, or other new networking technology, in the year 2003, the following changes may be made to the Coast Guard "network":

- ✧ Frame Relay will link together all Coast Guard units and will allow for technology insertion which will, in turn, allow the telecommunications system to take advantage of new technology over time.

- ✧ Commercial SATCOM (LEOS system) may replace regional satellite and geostationary INMARSAT services for meeting special purpose mobile voice and data communications requirements.

The example architecture provides a comprehensive networking solution capable of meeting all of the Coast Guard's current and future telecommunications requirements. It provides the ability to quickly and easily shape information into knowledge, and is designed to be flexible, configurable, and scaleable. The architecture consists of several telecommunications technologies that will best meet the Coast Guard's current and future telecommunications requirements with the least cost and risk.

Factors considered in the selection of Point-to-Point technology for the new data network are:

- **Availability:** T1 Point-to-Point technology was readily available for rapid and least risky implementation during the just-in-time installations of CGSWIII (June 96 to September 97).

- **Flexible and Scaleable:** Point-to-Point technology provides a flexible and scaleable networking solution.

- **Open Systems Compliant:** Point-to-Point technology, using Open Shortest Path First (OSPF) routing protocol, is non-proprietary and meets government open systems requirements.

- **Speed:** T1 Point-to-Point technology will provide a significant circuit capacity improvement over the current 56 kbps backbone network and will meet all current and future Coast Guard voice, data, and video requirements.

- **System Engineering:** Point-to-Point technology implementation requires the least up-front engineering of the available technologies (i.e., Frame Relay, ATM, SONET, etc.)

If the Coast Guard should decide to use Frame Relay services in the future, major factors which may be considered in the selection of Frame Relay over Point-to-Point, at that time, may be:

- **Speed:** Frame Relay has a more granular speed capability. This means that it has the capability to have a defined Committed Information Rate (CIR), which allows a connection speed to be defined in smaller increments than Point-to-Point can provide.

- **Virtual Circuits:** Frame Relay has the capability to define Permanent Virtual Circuits (PVCs). This allows the customer to define PVCs between the various site locations as multiple singular circuits are installed to the Frame Relay "cloud." The "virtual" circuits allow more efficient use of the network, by providing high volume paths.

- **Cost:** In the future, Frame Relay may be less costly to install and operate than Point-to-Point. By taking advantage of the CIR capabilities, excessive and wasted bandwidth can

be eliminated. After a usage history is established, the most cost effective bandwidths can be chosen, which will reduce overall costs.

- **More Flexible and Scaleable:** Due to dynamic CIR and PVC capabilities, future Frame Relay networks may be "tuned" much easier and faster than Point-to-Point. This means that the CIR can be quickly modified to provide more or less bandwidth, as required, between site locations.

Training

- **Data Network**: Operator training for the data network is commercially available. Technical system decisions have enabled the current base of X.25 knowledge to be easily adapted to Point-to-Point networks.

- **DMS**: The DMS implementation plan is still incomplete and final decisions have not yet been made on training availability.

- **MILSATCOM**: The Coast Guard is familiar with the operational and technical aspects of several military and commercial satellite communication systems, and training in some of these areas is already in place.

- **Specialized Cellular Service (CONDOR)**: Training for specialized cellular service capabilities will be available from commercial service providers.

Recommendation

The current networking initiative, CGDN Plus, should continue, as it will provide the most capable and cost effective solution to meet Program Manager requirements. The installed base will include all major and some smaller units by 1 September 1997.

Technology is changing at an extremely fast pace. With this in mind, the Coast Guard should consider implementing state-of-the-art technology (i.e., Frame Relay, ATM, SONET, etc.) by the year 2003, when a technology refreshment will most likely be needed. Frame Relay, for example, provides added levels of flexibility and scaleability, along with its own network management services, and may yield lower annual costs than Point-to-Point. The costs are very dependent on the selected Committed Information Rates (CIRs) at all units.

To provide connectivity to shore units where Frame Relay access is not available, ISDN, FTS2000 dial-up, or VSAT services could be used.

As DMS implementation comes to fruition, gateways, possibly located at several sites, such as OSC Martinsburg and the two Areas, will provide Coast Guard shoreside access to DMS. Ships may be linked to DMS over MILSATCOM which is expected to continue to be the primary means for ship-shore record message delivery.

Gateways to the INTERNET may be located at several locations. These sites may be Headquarters, OSC Martinsburg, and an additional site on the west coast. All Coast Guard access to the INTERNET should be via these sites, where appropriate safeguards will be provided to protect Coast Guard internal systems from unauthorized access. Additional gateways at other locations may be required as INTERNET access requirements increase over time.

Regional Satellite services and INMARSAT should continue to be available with coverage of the CONUS and coastal maritime areas for shore-based and mobile Coast Guard units when needed. After which, LEOSs will greatly expand the available coverage areas by offering service everywhere on Earth, including the polar regions where current satellite services cannot reach. LEOSs will also eliminate the requirement for stabilized dish antennas on mobile platforms. Increased competition may decrease costs of the current system.

Traditional MF and HF radio communications will continue to be used primarily as a backup system for satellite equipped vessels. It will also be needed to meet certain GMDSS requirements, and to maintain Coast Guard-Navy compatibility, as the Navy plans to continue its use of traditional radio communications into the next millennium.

VHF-FM communications may be augmented or replaced by emerging technologies sometime in the distant future. However, until then, VHF-FM will continue to be used to meet National Distress System (NDS), Global Maritime Distress and Safety System (GMDSS), and Coast Guard command and control requirements, as stated in Chapter 3.

Interoperability is a major benefit of specialized cellular service (CONDOR) which is expected to provide several enhancements over traditional wireless communications. Its secure (FORTEZZA card), dual mode (cellular/satellite) capability will provide mobile units with reliable world-wide voice and data connectivity. CONDOR's voice broadcast mode will provide an "all call" feature similar to the capability currently found in most traditional radio communication systems. Initial equipment and service costs will likely be high, as vendors recoup research and development costs. However, costs are expected to decline as multi-agency use of CONDOR increases.

Video requirements, for the foreseeable future, can be met using dial-up services via the Public Switched Telephone Network (PSTN). This will ensure the best possible service at the least cost to the user. PSTN dial-up services can be arranged on an "as needed" basis, which minimizes the recurring costs of leased lines.

It is important to keep in mind that costs and solutions available may vary depending on the geographic area. For example, equipment and circuit costs in "out of CONUS" areas (i.e. Alaska, Hawaii, Guam, FESEC, Caribbean) may be significantly higher than in CONUS, and the networking solutions available may be limited.